(ESA-122) Final Public Report

Introduction:

The J.R. Simplot, Don Plant is a fertilizer manufacturer located in Pocatello, Idaho. The facility burns sulfur to manufacture sulfuric acid used primarily to manufacture fertilizers. Steam is generated in a heat recovery boiler in Acid Plant 3, and used to drive a turbine powered blower, and steam is generated in a heat recovery boiler in Acid Plant 4 and used in a 16 megawatt turbine generator. Exhaust steam from the turbines is used for process heat and process steam is supplemented when necessary from two utility boilers using natural gas fuel.

Objective of ESA:

The purpose of the Steam energy saving assessment was to train the facility's engineering group to use the Department of Energy steam tools, to create a model of the plant steam system, and to identify projects that will save energy.

Focus of Assessment:

The Plant generates steam as a byproduct of manufacturing sulfuric acid. They operate a multi-pressure extraction Steam Turbine Generator and the power is sold to Idaho Power. They balance the plant steam load by operating natural gas fired boilers when the plant load exceeds the capacity of the two sulfuric acid plants, and under certain situations they vent excess steam to atmosphere to insure maximum sulfuric acid production. If we can find ways to improve the efficiency of the process we believe we can devote more steam to the generation of additional electrical energy for sale and internal use, we can reduce steam venting, and we can reduce the amount of natural gas that must be burned to supplement the plant process steam requirements.

Approach for ESA:

We reviewed the Department of Energy Steam System Scoping Tool with Steve Sternberg, Paul Malek, Henry Holm, Byron Smith, Randy Harris, and Gary Byington. We used this information and other specific information from the evaluation team to begin the modeling process. We toured Acid Plant 4, the Turbine Generator and the Acid Plant 4 control room. We toured Acid Plant 3, observed the operation of the steam turbine driven blower, and the operation of the pressure reducing stations. Finally we visited the Utility Boiler control room and the central facility control room.

In addition to the 16 megawatt turbine generator the facility operates a 3000 HP turbine blower drive, and has turbine driven feed water pumps installed. None of the feed water pumps were currently operating and the operator cited maintenance challenges with the pumps.

We used 3E Plus software to build a metric for determining the heat loss in portions of the plant distribution system that have bare or poorly insulated pipe. The plant has recently instituted a steam trap and steam leak maintenance program and we inserted data from the steam trap survey into the SSAT model for the plant.

By the end of the first day of work Henry Holm was manipulating the SSAT model to develop a comprehensive list of steam system improvement opportunities, and during the exit meeting Paul Malek manipulated the SSAT model to demonstrate the opportunities for improvement to plant management. On the second day we spent significant time computing steam turbine isentropic efficiencies, demonstrating the use of the 3EPlus software, and adjusting the SSAT model to insure that all of the training audit team members were satisfied that the SSAT model represented the current plant operation.

General Observations of Potential Opportunities:

The energy loss associated with venting steam is large. Steam must be vented to maximize sulfuric acid production but it is imperative that we not be operating the natural gas boilers and venting at the same time. The facility balances the steam loads through pressure reducing stations. There may be a significant opportunity to increase power generation and to reduce the volume of vent steam by installing back pressure turbine generators in place of the reducing stations.

1. Reduce Steam Demand. The utility boilers do not operate continuously and some of the operation of the utility boilers is just to keep them hot. When this is done steam is generated in the utility boilers at the same time that steam is being vented. By installing drum heaters that utilize flash steam to keep the utility boilers hot it is estimated that we can reduce utility boiler natural gas use by 5%. This is a medium term opportunity because it will require the installation of drum heaters in the mud drum of each of the utility boilers.
2. Reduce Vented Steam. This is similar to item one above. The facility vents on average 57,000 lbs/hr of steam to insure maximum sulfuric acid production. It was thought by the audit team that through judicious plant management can we could reduce steam venting by 10% (5,700 lbs/hr)? This a near term project as no new equipment is required.
3. Change Condensate Recovery Rates. Repair the return condensate system to return 15% more medium pressure condensate to the system (2715 gph). This is a medium term project because it will require the replacement of a medium pressure condensate line and the repair of condensate pumping stations.
4. Implement Steam Trap Maintenance Program. This program is already in the early stages of implementation. We used the recently completed plant steam trap survey data for the SSAT model and then used a project to repair traps regularly.
5. Implement Steam Leak Maintenance Program. Institute a program to use the steam leak survey and develop an ongoing program to repair leaks regularly. We used plant survey data to enter the number of leaks on each header and then exercised an SSAT project to repair the leaks regularly.
6. Improve Insulation. Develop a plant survey of pipe insulation. Determine the length and size of places where insulation has probably been removed for maintenance and then not replaced. We demonstrated a technique to utilize the 3EPlus software to build a matrix of bare pipe heat loss for various pipe sizes. By inserting the feet of bare pipe from a plant survey into matrix the model will calculate the heat loss on each of the steam headers and a project can be exercised in the SSAT model to accurately predict the savings from insulating the sections of bare pipe. The savings is unknown because the survey has not been completed.

The above opportunities are not capital intensive. The following project has a very large potential savings and it will require capital investment.

7. Add back pressure steam turbine generators. Replace the reducing stations in the area of Acid Plant 3 with back pressure turbine generators operated to balance the low pressure headers. The turbines will reduce the steam pressure and they will extract energy from the steam going to the process thereby reducing the amount of steam vented to atmosphere. The electricity from these units could be used in house to reduce the facility electric bill. This is a long term project as it will require an engineering feasibility study and significant capital expense to recover the savings.

Potential fuel savings from above improvements:

Near-Term	98,099 MMBtu	12.2% savings
Medium-Term	37,549 MMBtu	4.7% savings
Long-Term	3,860 MMBtu	0.5% savings
Total	139,508 MMBtu	17.3%

Management Support and Comments:

Steve Sternberg arranged kick off and exit meetings with management. Paul Malek and Henry Holm worked with me throughout the three day training audit, and Steve Sternberg and Byron Smith participated often. The audit team presented its findings to approximately 12 very interested people during the exit meeting.

DOE Contact at Plant/Company: Steve Sternberg
Agribusiness Engineer

208-235-5686
ssternberg@simplot.com